

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

BIOLOGICAL EVALUATIONS OF SPRUCE BUDWORM INFESTATIONS IN 1966

on the

BOISE, BRIDGER, CHALLIS, FISHLAKE, PAYETTE, SALMON, SAWTOOTH, AND TARGHEE
NATIONAL FORESTS

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(Excerpts from reports on forest insect conditions on the above-named National Forests during 1966)



U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
INTERMOUNTAIN REGION
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BOISE NATIONAL FOREST, 1966

For several years populations of the spruce budworm have persisted in the wilderness area of the forest along the Middle Fork of the Salmon River. Douglas-fir and true firs have been defoliated to varying degrees and last year (1965) tree mortality was observed from Marble Creek downstream to Norton Ridge. Tree killing was most pronounced in reproduction pole-sized trees. The mortality occurred in a spotty or patchy, configuration.

Aerial detection flights this year showed that the infestation had decreased slightly in size, from 60,200 acres in 1965 to 59,400 acres. The most significant happening to these populations occurred as an overall reduction in total numbers. This was first detected when the aerial survey flights disclosed that 56,800 acres were classed as light. The remaining 2,600 acres were moderately defoliated. Last year the entire 60,200 acres were heavily defoliated. Ground checks showed that larval populations were definitely down from what were observed in 1965.

The decided downward trend in budworm activity coincided with conditions observed on the bordering Challis, Payette, and Salmon Forests where populations had also dropped off during the past year. The reasons for reductions in budworm activity have pretty well been narrowed to effects of adverse weather. There are two periods in this pest's life cycle where the larvae are highly susceptible to the effects of cold weather: First, when the tiny larvae hatch from the egg and start crawling to their winter hibernaculum sites; second, when the larvae leave the hibernaculæ in late spring and start searching for new buds which they mine. Coincident with these developmental times in the insects life cycle, periods of hard freezes were experienced in the fall (1965) and spring (1966). It is felt that these freezes were primarily responsible for the current population reductions. Also, there was undoubtedly a supplementary impact on the budworm from native predator-parasite complexes that have been associated with the populations for a considerable period of time.

Even though the total number of budworm larvae were reduced, surviving residual populations are still present. These individuals are considered a "biological reservoir" and have the potential to cause reinfestation, if biological and climatological factors are suitable for their development.

In summary, budworm populations have been slowed down due to adverse weather conditions affecting the critical stages of development. Also, native predators and parasites have added impetus to the reduction in total numbers of the pest. Adverse weather conditions are extremely helpful when they occur, but cannot be counted on from year to year. It is felt that the fir stands, heavily damaged in the past, will have at least one season to partially recuperate.

BRIDGER NATIONAL FOREST, 1966

This is the second consecutive year of observed spruce budworm activity on the Bridger National Forest. Originally confined to the Greys River and Little Greys River drainages, the infestation has extended itself outward in practically all directions with the most noticeable movement being to the north on the south side of the Snake River. In some areas defoliation intensity increased slightly but not enough to produce any significant damage. The heaviest noticeable defoliation encompassed some 800 acres of moderately damaged Douglas-fir, alpine fir and Engelmann spruce between the South Fork of Little Greys River and Stewart Creek. Elsewhere defoliation remained in the light category. A resume of infested acreage for 1965 and 1966 by defoliation categories as determined by aerial surveys follows:

| Year | <u>Light</u> | Medium | <u>Heavy</u> | Total |
|------|--------------|--------|--------------|--------|
| 1965 | 10,000 | | | 10,000 |
| 1966 | 33,000 | 800 | | 33,800 |

On-the-ground examinations supported these aerial findings. Although defoliation was generally widespread in the areas examined it was of light intensity with no immediate threat to the affected trees.

This spruce budworm infestation is one of the few infestations in the Region that did not decline this year. Unseasonable subfreezing temperatures last fall and again this spring caused a drastic budworm decline on the Salmon, Challis, Payette National Forests and portions of the Targhee National Forest in Idaho and on the Fishlake National Forest in Utah. For reasons unknown, budworm infestations on portions of the Sawtooth, Targhee and Bridger National Forests continue to persist.

Reliable predictions as to population trend and defoliation can be made from systematic sampling of Douglas-fir foliage for overwintering egg masses. Collection areas, egg mass counts for this year and last and defoliation estimates for 1967 follows:

| | Egg masses/1000 sq. in. | | Predicted Defoliation | Trend |
|--------------------|-------------------------|----------------------|--------------------------|---------|
| | <u>1965</u> (No.) | <u>1966</u> (No.) | <u>1967</u> (Percent) | |
| Bailey Lake | 12.7 | 0.1 | 15 | Down |
| Porcupine Creek #1 | 3.7 | 5.7 | 25-50 | Static |
| Porcupine Creek #2 | | 2.7 | 15 | Unknown |

BRIDGER NATIONAL FOREST, 1966 (continued)

Intensity and extent of defoliation in 1967 will not change appreciably from that experienced this year. Moderate to light defoliation will occur in Grizzly Basin, between Stewart Creek and south fork of Little Greys River, with light to negligible damage occurring elsewhere. The infestation will be checked next spring and summer and the Forest will be promptly notified of any unexpected change.

CHALLIS NATIONAL FOREST, 1966

Spruce budworm activity has been at epidemic levels on the Challis National Forest for several years and is part of a four forest complex known as the Salmon River infestation. In 1964, 454,000 acres were defoliated. In 1965, a slight drop to 401,300 acres was observed. During 1966, aerial and ground surveys showed that a drastic reduction in the size and intensity of the budworm population had occurred. A total of 169,100 acres of defoliated Douglas-fir and true firs were mapped in. This was a 42% reduction from the 1965 infestation. Infestation by years and intensity with total number of acres affected is shown in the following table:

| Year | <u>Light</u> | Medium | <u>Heavy</u> | Total |
|------|--------------|---------|--------------|---------|
| 1964 | 79,000 | 132,000 | 243,000 | 454,000 |
| 1965 | 83,200 | 20,500 | 297,600 | 401,300 |
| 1966 | 162,100 | 7,000 | | 169,100 |

The decided downward trend in budworm defoliation coincided precisely with conditions observed on the bordering Payette, Salmon, and Boise National Forests where populations dropped off drastically during the past year. The reasons for these reductions in budworm activity have pretty well been narrowed to effects of adverse weather. There are two periods in this pest's life cycle when the larvae are highly susceptible to the effects of cold weather; first, when the tiny larvae hatch from the egg and start crawling to their winter hibernaculum sites; second, when the larvae leave their hibernaculae and start searching for new buds which they mine. These two periods occur in the fall and spring, respectively. Coincident with these developmental times in the insects' life cycle, periods of hard freezes were experienced in 1965 (fall) and in the spring of 1966. It is felt that these timely freezes were primarily responsible for the current population reductions. Also, there was undoubtedly a supplementary impact on the budworm from native predator-parasite complexes that have been associated with populations for a considerable period of time.

In past years entomologists have made egg mass surveys shortly after the adults have emerged and completed their egg laying. The number of egg masses are counted per thousand square inches of foliage and predictions made as to the possible trend of the infestation for the forthcoming year. In 1965 freezing weather occurred after egg masses had been collected. The egg mass counts indicated that budworm populations were expected to remain at relatively high levels in 1966. Shortly after egg mass collections were made young larvae emerged and were caught by freezing weather. We were not aware of what had happened until the following spring.

The first indication of overall population reductions occurred when entomologists began sampling defoliated areas in preparation for the Salmon spruce budworm control project. As sampling continued it became evident that populations were so light that the project should be cancelled. In late June the main Malathion project was cancelled out. However, the Zectran study project was still being considered as a going operation. A crash program of evaluations

CHALLIS NATIONAL FOREST, 1966 (continued)

was undertaken to find an area suitable for the Zectran test. It was at this time that light populations of budworm were found on the Challis Forest. Areas that had been moderately to heavily defoliated in 1965 were supporting only light populations and the plans to move the Zectran project to the Challis Forest had to be cancelled.

Even though the total number of budworm larvae had been reduced, surviving residual populations were still present. These individuals are considered a biological reservoir and have the potential to cause reinfestations if biological and climatological factors are suitable for their development in the forthcoming year. At the end of this year's egg mass sampling, a total of ten plots were sampled on the forest. Nine of the ten plots showed a predicted defoliation of less than 15% for 1967. Morse Creek was the only area where predicted defoliation goes from 25 to 50 percent.

In summary, budworm populations have slowed down due to the effects of adverse weather conditions at two critical stages in their life cycle. Also, native predators and parasites have added impetus to the reduction in the total numbers of the pests. Adverse weather conditions are extremely helpful when they occur but cannot be counted on from year to year. It is felt that the Douglas-fir and true fir stands will have a least one season to partially recuperate.

FISHLAKE NATIONAL FOREST, 1966

This is the third consecutive year of spruce budworm activity on the Fishlake National Forest. The first known occurrence of budworm damage was in 1964 when some 20,000 acres of defoliation was reported. Last year, in some areas feeding intensity increased, but only 10,000 acres of infestation were mapped. Predictions for 1966 forecast a static condition throughout the infestation with only moderate to light defoliation expected. A sharp decline in the population occurred, however, and almost no noticeable defoliation or other indication of insect activity was observed this year.

Reasons for this unexpected drop in budworm populations have not been positively determined. This sudden decline was most likely caused by unfavorable weather factors; more specifically lethal subfreezing fall and spring temperatures. Last September was unusually cold and early frosts, particularly in the higher elevations, caught non-hatched and late hatching larvae before they became acclimated and had settled into their overwintering sites. According to the Utah State Climatologist, last September was not only the coldest September in history, but 44 stations recorded the morning of September 18, as the coldest September day on record.

May was unusually warm and the surviving budworms broke hibernation earlier than normal and began to enter and feed within the rapidly developing buds. Neither budworm larvae nor the succulent spring growth were able to withstand the subfreezing weather that followed. Lethal below freezing temperatures, first in early June and again in late June, killed most of the growth and most of the larvae. The late frosts had an indirect killing effect also, for they undoubtedly deprived many of the surviving larvae of food. This phenomenon also occurred throughout most of the large budworm infestations in southern Idaho.

Examinations made early this summer more or less confirmed this diagnosis. Frozen 1966 foliage was found in practically all infested areas. Some trees had as many as 70 to 90 percent of their buds and new shoots killed by these late frosts. Many small dead budworm larvae were found in the frozen buds.

A followup egg mass evaluation survey was undertaken this fall to provide an estimate of next year's population level. The results of the survey and predictions as to expected defoliation in 1967 follows:

| Area | Egg Masses per 1000 sq. inches | Predicted 1967 Defoliation (Percent) |
|----------------------------|-----------------------------------|--|
| Thousand Lakes Mountain #1 | 1.61 | <15 |
| Thousand Lakes Mountain #2 | 2.70 | 15 |
| Kent Lake | .19 | <15 |
| Grindstone Flat | .15 | <15 |

FISHLAKE NATIONAL FOREST, 1966 (continued)

The present extremely low level of spruce budworm populations should continue through 1967. Some light defoliation may be evident in the Elkhorn - Thousand Lake Mountain area but no significant or lasting damage should occur. Elsewhere budworm activity will be negligible and it will probably be at least 2 to 3 years before the population returns to its 1965 level.

PAYETTE NATIONAL FOREST, 1966

For several years populations of the spruce budworm have persisted in wilderness areas of the forest and are contiguous with infestations occurring on the Salmon, Challis, and Boise National Forests. Douglas-fir and true firs suffered light to extremely heavy defoliation along the Middle Fork of the Salmon River with tree mortality beginning to show up in 1965. The mortality occurred in patches in reproduction and pole size timber. No large scale killing has been observed so far.

Aerial observers this year found five new outbreaks of the spruce budworm. Four of these occur outside of the wilderness area, and are located in Split Creek, the Middle Fork of Elk Creek, and in an area running from French Creek to Canada Saddle along the Salmon River breaks. Two new wilderness infestations showed up, one in Five Mile Creek; and the other in Shellrock Creek. Even though new infestation centers were encountered, the overall character of the main infestation dropped off markedly as far as defoliation and number of acres affected were concerned. At present, 83,700 acres have been defoliated, and except for one small area, the defoliation pattern has been classed as light. This is in sharp contrast with the 217,000 acres that were mapped in during the 1965 aerial survey season. Limited ground checks showed that budworm populations had definitely declined during the 1966 field season.

The decided downward trend in budworm activity coincided precisely with conditions observed on the bordering Boise, Challis, and Salmon National Forests where populations also dropped off during the past year. Reductions in budworm activity have pretty well been narrowed to the effect of adverse weather. There are two periods in this pest's life cycle where the larvae are highly susceptible to cold weather. First, from the time the larvae hatch from the egg and start crawling to their winter hibernaculum sites; second, when the larvae leave the hibernaculae and start searching for new buds which they mine. These two periods occur in the fall and spring, respectively. Coincident with these developmental times in the insects life cycle, periods of hard freezes were experienced in 1965 (fall) and in 1966 (spring). It is felt that these freezes were primarily responsible for current population reductions. Also, there was undoubtedly a supplementary impact on the budworm from native predator-parasite complexes that have been associated with populations for a considerable period of time. Even though the total number of budworm larvae were reduced, surviving residual populations are still present. These individuals are considered a biological reservoir and have the potential to cause reinfestation if biological and climatological factors are suitable for their development in the future.

In summary, budworm populations have slowed down due to a combination of adverse weather conditions at two critical phases of their life cycle; also, native predators and parasites have added impetus to the reduction in the total numbers of the pest. Unfavorable weather conditions are extremely helpful when they occur but cannot be counted on from year to year. With this in mind, it is felt that the fir stands will have at least one year's period of time in which to partially recuperate.

SALMON NATIONAL FOREST, 1966

The spruce budworm received a major setback on the Salmon National Forest this year. Predictions made in 1965 forecast continued defoliation on more than 700,000 acres with heavy defoliation and subsequent tree damage expected on more than one third of this total area. Plans for 1966 were to treat 120,000 acres of threatened Douglas-fir timber. Contrary to the early predictions, however, the anticipated heavy budworm populations did not materialize; consequently the proposed spray program was cancelled. On the ground spot checks were made in previously infested areas and elsewhere on the forest but only scattered, light larval populations were detected.

The primary reason for this unexpected population decline is believed to have been unseasonal frosts which occurred in the fall of 1965 and spring of 1966. Weather records showed subfreezing temperatures throughout Idaho and elsewhere in the Intermountain Region in the middle of September last year. Practically all weather stations in the mountainous areas of central Idaho reported below freezing minimum daily temperatures for the period September 16 - 19. Salmon, for example, reported minimum temperatures of 28, 18, 18 and 22°F for the four-day period. At that time spruce budworm egg hatch was complete at the lower elevations and larvae were established in their overwintering niches - protected and reasonably acclimatized against the forthcoming winter. At higher elevations it is suspected that some mortality did occur. Late hatching larvae may have been caught by subfreezing temperatures before they became acclimatized or were secure in their hibernating sites. A high but unmeasurable incidence of nonhatch of 1965 egg masses collected from selected locations in the forest suggests this possibility.

Additional budworm kill was caused by low temperatures during late spring and early summer of this year. May was unseasonably warm with practically all stations throughout the state reporting above-average temperatures. These warm temperatures hastened both budworm and foliage development at all elevations. By the first week in June, budworm larvae had passed through the needle mining stage and entered the expanding buds or were feeding in the embryonic shoots. On June 4th and 5th, subfreezing temperatures killed the frost-susceptible buds and shoots along with many of the budworm. This late frost would likely have had little effect on the budworm population had it not been for the abnormally warm weather in May. The late frost was indirectly responsible for additional budworm mortality for it undoubtedly deprived many of the surviving larvae of food. The same thing was repeated in late June when both foliage and budworm were considerably more advanced and less able to survive subfreezing temperatures. The second frost hit the state the last week of June. Most of the low elevation weather stations recorded subfreezing temperatures on the 25th and 26th of June. It can be assumed that temperatures at higher elevations were even lower than those at the weather stations.

Both the extent and degree of noticeable spruce budworm defoliation decreased markedly from that recorded last year. A breakdown by damage categories of the total infested acreage this year and last as recorded by aerial surveys follows:

SALMON NATIONAL FOREST, 1966 (continued)

INFESTATION INTENSITY

| Year | <u>Light</u> | Medium | <u>Heavy</u> | Total |
|------|--------------|--------|--------------|---------|
| 1965 | 296,500 | 77,400 | 336,000 | 709,900 |
| 1966 | 495,700 | 25,900 | | 521,600 |

Of greater significance than the overall decrease in infested acreage is the complete lack of heavy feeding damage this year. This respite will permit many weakened trees to at least partially recover from the effects of repeated severe defoliation.

Although more than one half million acres have been classed as damaged by budworm feeding, the actual infested acreage may be somewhat lower. Frost damage on Douglas-fir was so extreme and extensive that, in many areas and under certain light conditions, it was difficult for the aerial observers to separate it from budworm activity; consequently, all discernible foliage discoloration was mapped as spruce budworm damage. Further evidence of light budworm populations is found in the data derived from egg mass collections. The 1966 egg mass counts, comparisons with 1965 counts, and defoliation and trend predictions for 1967 follows:

| | Egg Masses/1000 sq. in. and Expected Defoliation | | | Trend |
|-------------------|---|----------------------|--------------------|---------|
| | <u>1965</u> (No.) | <u>1966</u> (No.) | <u>1967</u> (%) | |
| Agency Creek | 23.0 | 8.9 | 25-50 | Down |
| Copper Creek | | 0.4 | 15 | Unknown |
| Dahlonga Creek | 8.9 | 0.2 | 15 | Down |
| Derian Creek | 23.9 | 11.3 | 51-90 | Down |
| Freeman Creek | | 4.7 | 15-25 | Unknown |
| Hayden Creek | 20.2 | 4.8 | 15-25 | Down |
| Indian Creek | | 0.0 | | Unknown |
| Iron Creek (S.F.) | | 1.0 | 15 | Unknown |
| Jesse Creek | | 18.8 | 90-100 | Unknown |
| McDivitt Creek | 22.7 | 7.1 | 25-50 | Down |
| Middle Fork Peak | | 0.6 | 15 | Unknown |
| Moyer Creek | 12.2 | 0.7 | 15 | Down |
| Pine Creek | | 0.1 | 15 | Unknown |
| Porphyry Creek | 2.3 | 0.0 | | Down |
| Rabbits Foot | 0.9 | 0.1 | 15 | Static |
| Spring Creek | | 0.0 | | Unknown |
| Timber Creek | 50.3 | 3.1 | 15-25 | Down |
| Votler Creek | | 0.0 | | Unknown |
| Williams Creek | 9.7 | 1.7 | 15 | Down |

SALMON NATIONAL FOREST, 1966 (continued)

Of the 19 plots sampled, only 10 were sampled last year. In each case, however, significantly fewer egg masses were found this year. Samples were taken inside and outside of known defoliated areas to measure trends in existing infestations and detect budworm presence in others. Barring another unexpected population decline such as happened this year, intensity and extent of defoliation will increase slightly, but with few exceptions damage will be low next year. Heaviest defoliation will occur in and near the Jesse-Derian Creek drainages. Moderate feeding will occur in and adjacent to Agency and McDivitt Creeks with light to negligible defoliation occurring elsewhere. Experience has shown, however, that this respite from budworm feeding may be only temporary and in a matter of time, 2 to 3 years perhaps, budworm populations will increase again.

SAWTOOTH NATIONAL FOREST, 1966

Spruce budworm populations have persisted in the Big Smokey area for the past eleven years in Douglas-fir and true firs. The infestation has fluctuated from a low of 9,000 acres in 1965 to a current high of 110,000 acres. Although defoliation was more extensive this year than last, most of the damage was in the light category.

A breakdown of defoliation categories for the past six years compiled from aerial survey flights follows:

Spruce budworm defoliation by year, intensity, and acres

| <u>Year</u> | <u>Light</u> | <u>Medium</u> | <u>Heavy</u> | <u>Total</u> |
|-------------|--------------|---------------|--------------|--------------|
| 1961 | 5,000 | 3,000 | 5,000 | 13,000 |
| 1962 | 4,000 | 10,000 | 27,000 | 41,000 |
| 1963 | 14,720 | 25,440 | 20,000 | 60,160 |
| 1964 | 32,000 | 21,000 | 1,000 | 54,000 |
| 1965 | | 9,000 | | 9,000 |
| 1966 | 78,500 | 15,400 | 16,100 | 110,000 |

This infestation has had a past history of rapid population fluctuations that can be attributed to a combination predator-parasite influence and periods of adverse weather. A somewhat dramatic population reduction occurred in the summer of 1960. During the period when adult moths were flying, high intensity hail and rain storms passed through the infested area and literally millions of moths were beaten to death or drowned. The infestation dropped from 40,000 acres in 1960 to 13,000 acres in 1961 with defoliation intensities also being reduced. This is but one example of how adverse weather conditions can influence populations of the budworm.

During the past field season, semi-permanent sampling areas were established throughout spruce budworm infested stands in southern Idaho. New sample locations will be added as needed each year to include as much of a given infestation as is practical. For instance, in 1965 five areas were sampled on the forest. This year ten sampling points were established. It is felt that visitation from year to year at pre-established sampling points will provide more definitive data to the entomologists who in turn can give more meaningful information to the land managers on the trend and course of an infestation.

SAWTOOTH NATIONAL FOREST, 1966 (continued)

Data from this year's egg mass sampling plots is presented in the following table:

| Sample Plot Location | <u>1966 Spruce Budworm Egg Mass Survey</u> | | |
|----------------------------|--|--------------------------------|--------|
| | Average No. Egg Masses | Expected | Trend |
| | per 1000 sq. in. of <u>Foliage</u> | Defoliation <u>1967 (%)</u> | |
| Little Smokey Creek | 5.51 | 25-50 | Static |
| Lower Bounds Creek | 4.08 | 15-25 | Static |
| Upper Bounds Creek | 0.12 | <15 | Dec. |
| South Fleck Summit | 12.00 | 51-90 | Inc. |
| North Fleck Summit | 11.37 | 51-90 | Inc. |
| Couch Summit | 8.72 | 25-50 | Static |
| Boardman Creek | 3.25 | 15-25 | Inc. |
| Carrie Creek | 0.90 | <15 | Static |
| Bridge Creek | 2.70 | <15 | Static |
| Sidney Butte | 4.83 | 15-25 | Inc. |

The foregoing egg mass data indicates that budworm populations are expected to persist through the 1967 field season. This year, heaviest defoliation occurred on approximately 35,000 acres of Douglas-fir and true firs near Big Smoky Guard Station. Egg mass data indicate that next year's defoliation of the new growth will range from 25 to 90% in this same general area. This may be a fortunate occurrence as the area has been selected for testing a promising insecticide, Zectran, against larval populations of spruce budworm in 1967.

In retrospect, the insecticide testing laboratory at Berkeley, California, needed a typical budworm area in which a comprehensive and conclusive test of Zectran could be made. The foremost criteria for the test was that of having sufficient populations of budworm to work with. Previous to last year (1965) thousands of acres of infested fir were available for test purposes in southern Idaho. Then, a sudden collapse of budworm populations occurred, probably due to adverse climatological and biological factors. The Sawtooth infestation was the least affected area in southern Idaho and therefore was the logical selection for the Zectran tests during 1967.

After selection of the test area it was necessary to accurately delineate the project boundaries. This was accomplished from the air with a helicopter, followed by extensive ground checking. In the course of this survey work it was found that negligible to light populations of the budworm were occurring over several thousand acres. During fixed-wing detection flights early this summer, only 30,000 acres of defoliation were recorded. With the helicopter it was possible to discern very light activity, consequently an additional 80,000 gross acres were mapped in. However, because of open slopes, bare ridges, and the scattered nature of stands, an estimated actual area of 60,000 acres of Douglas-fir and true firs will constitute the test area. Heavy defoliation occurred in areas of previous heavy defoliation. The largest increase in defoliation was in the light category. Even though other areas of Idaho experienced sudden reductions in population levels in 1965-1966, the Sawtooth infestation increased in size and defoliation intensity. With the proposal to field test Zectran, it would be highly desirable to spray as much of the area as is possible in 1967.

TARGHEE NATIONAL FOREST, 1966

Spruce budworm populations and subsequent defoliation decreased in some areas and increased in others this year. Predictions made in 1965 forecast a receding population trend in all of the infestation areas this year. This population decline occurred throughout all of the previously infested areas, but the extent of the decline exceeded initial predictions. From the air no defoliation was visible in the 97,000 acres defoliated in 1965. This includes over 9,000 acres of heavy 1965 defoliation in the area east of Humphrey.

The reasons for this unexpected decline in budworm numbers is two-fold: First, 1965 egg mass counts were generally low and indicated light populations, hence light defoliation, in the infestation areas; secondly, unseasonable frosts during September of last year and June of this year further limited the already decreasing budworm population. The June frosts took a heavy toll for they followed an unusually warm May which hastened both tree and budworm development, making them less able to withstand subfreezing conditions.

The frosts were not nearly as severe on the Targhee as they were elsewhere in the Region, however. The same series of early and late frosts dealt the spruce budworm a major setback on the Salmon, Payette and Challis National Forests in Idaho and the Fishlake National Forest in Utah.

One area where these frosts failed to affect the budworm adversely is in the Pine Creek drainage in the southern end of the Forest. Defoliation confined to only a small area last year, increased to over 14,000 acres this year. Major areas of defoliation were Pole Canyon, Mike Spencer Canyon and along the south slope of Ramsey Creek. All feeding activity was classed as light with Douglas-fir, subalpine fir and Engelmann spruce the prime hosts. Interestingly, feeding damage on Douglas-fir was considerably lighter than that on true fir and spruce, which is usually not the case. For comparative purposes, a breakdown of infested acreage by damage classes for this year and last as determined by aerial surveys follows:

| Year | Defoliation Intensity | | | Total |
|------|-----------------------|--------|--------------|--------|
| | <u>Light</u> | Medium | <u>Heavy</u> | |
| 1965 | 46,100 | 42,600 | 9,200 | 97,900 |
| 1966 | 14,600 | | | 14,600 |

Of considerable importance is the fact that no areas underwent heavy or even moderate defoliation this year. Many trees that have undergone repeated defoliation for several successive years will have an opportunity to recover.

Egg mass collections taken from Douglas-fir foliage provide an estimate of population trend and expected damage. Collections were made in previously defoliated areas and in new areas. The results of the egg mass survey and predictions as to the degree of damage that can be expected in 1967 follows:

TARGHEE NATIONAL FOREST, 1966 (continued)

| Area | Egg masses/1000 sq. in. | Expected Defoliation | Trend | |
|----------------|-------------------------|----------------------|-------|--------------------------|
| | $\frac{1965}{(No.)}$ | $\frac{1966}{(No.)}$ | | $\frac{1967}{(Percent)}$ |
| Targhee Creek | 0.0 | 0.0 | <15 | Static |
| Howard Springs | 0.0 | 0.0 | <15 | Static |
| Twin Creek | 0.0 | 0.0 | <15 | Static |
| Gillan Creek | 0.7 | 0.1 | <15 | Static |
| Pole Creek | | 2.2 | <15 | Unknown |
| Mike Spencer | | .5 | <15 | Unknown |

Heaviest defoliation will occur in and near the Pine Creek drainage but this will still remain in the light category. All other areas will receive light to negligible defoliation. In some areas the sugar pine tortrix, Choristoneura lambertiana, may confound the situation somewhat for when it is epidemic in lodgepole pine, it will feed on Douglas-fir, true fir, and Engelmann spruce, when those species are components of a lodgepole stand. This defoliator complex will be investigated at greater length next summer.

Spider mite populations in the 1963 DDT spray area and elsewhere on the Forest are at a low level and should remain in that status through 1967.